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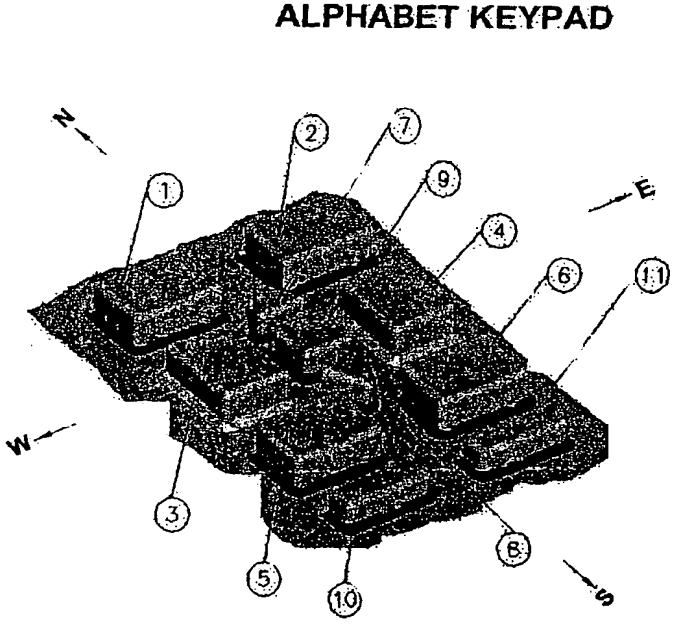
(54) Title: THUMB TOUCH TYPING



DIMENSIONS	HEIGHT	WIDTH
Keypad	6.4 cm	4.4 cm
Key Block (1,2,5,6)	1.6 cm	1.5 cm
Key Block (3,4)	1.2 cm	1.2 cm
Space Key (9)	1.0 cm	1.3 cm

(57) Abstract: THUMB TOUCH TYPING A wearable hand-held ergonomic keyboard device which allows thumb touch-typing (eyes-off typing with the thumb). The device can be used for conventional sight-typing using hunt and peck with fingers. The key legends displays all the ASCII characters, while adopting the simple to learn "ABCD" layout. Provision is made for alphabetic/phonetic typing of various scripts of the world, in a manner that their legends don't need to be simultaneously shown and UNICODE characters can be generated. A navigation keypad and a Pointing device is provided to complement the Alphabet keypad. The bottom surface of the device has an adjustable strap which allows three or four fingers of a hand to be easily slid into position such that the thumb gets raised high enough to stroke all the keys on the top surface, while the index finger can operate a pointing device such as a track-ball.

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Declaration under Rule 4.17:

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

1.1 Title of the Invention

THUMB TOUCH TYPING

1.1.1 Prior Application

This application claims priority of U.S. provisional patent application 60/373,498 filed April 18, 2002.

1.1.2 Field of the Invention

A hand-held thumb touch typable ASCII/UNICODE keyboard with a pointing device for mobile communication/computing. Mobile telephone, Personal Digital Assistants, Touch typing, ASCII/UNICODE keyboard. TV/VCR Remote control. Wearable computers. Hand held keyboard. Ambidextrous keyboard.

1.2 Abstract of the Invention

A wearable hand-held ergonomic keyboard device which allows thumb touch-typing (eyes-off typing with the thumb). The device can be used for conventional sight-typing using hunt and peck with fingers. The key legends displays all the ASCII characters, while adopting the simple to learn "ABCD" layout. Provision is made for alphabetic/phonetic typing of various scripts of the world, in a manner that their legends don't need to be simultaneously shown and UNICODE characters can be generated. A navigation keypad and a Pointing device is provided to complement the Alphabet keypad. The bottom surface of the device has an adjustable strap which allows three or four fingers of a hand to be easily slid into position such that the thumb gets raised high enough to stroke all the keys on the top surface, while the index finger can operate a pointing device such as a track-ball.

1.3 Background of the Invention

1.3.1 Getting the Thoughts Across

Perhaps the biggest invention, which we are waiting for will be a device which will sense the neural signals in some part of our brain, and convert them to transmittable codes. In

this way thoughts would get communicated through ASCII/UNICODE – without any movement of hand or twitching of a muscle, as effortlessly as speaking.

This will indeed mark a long way from the time the primitive man drew pictures of beasts on the cave wall – and the art of writing started in an ideographic manner. What distinguished man from the apes was the highly developed thumb, which could oppose the other four fingers for grasping and manipulating an object. This feat of evolution became possible by evolving a disproportionately large area of the brain for control of the thumb – more than that given for other limbs and even vocal tracts.

The thumb, gave a spur to development of tools – and indirectly to intellect development for handling the tools. With the advent of scripts – written through a device such as quill, pencil or a pen – the thumb literally ushered the literary world of today. Today's emphasis is on teaching of the hand-writing skills from the child-hood such that it becomes part of the "procedural memory" (stored in the cerebellum). This way, the mind of an author can remain in its thought plane, while the hand inscribes it faithfully on the paper.

A prominent advantage of handwriting is that it can be done with only one hand, freeing up the other for supporting activities. However, because of the very specialized nature of this skill, it gets tied to one hand – which-ever the person got initiated with. A handicap is then faced, say, when a right-handed person has to jot down something and his right hand is tied up in some activity.

1.3.2 Traditional Typing

The advent of typewriters and their keyboards gave a new fillip to the writing skills. It was now possible to use fingers of both the hands to type accurately and faster. The bottle-neck of the hand-writing legibility and speed was removed. "Touch-typing" techniques were developed whereby it was possible to type with both hands, without looking at the keyboard. Touch-typing, permitted an author to remain in his thought plane while the fingers automatically transcribed the thoughts on the paper. With the

advent of the "soft touch" computer keyboards – way was ultimately paved for knowledgeable users to compose and send e-mails.

The typewriter keyboard, especially with its infamous "QWERTY" layout, has generated its share of problems too – limiting the application areas. It's meant to be operated by both hands, and further more with a proper seating posture. Its crazy alphabetic layout, deters most people from touch typing. They get, reduced to hunt and peck typing with one or two fingers. Once people get used to the "sight typing" habit, it comes in the way of learning touch typing, which requires systematic use of fingers. In sight typing a person gets impaired in speed, and cannot manage automatic typing action required for on-line authoring.

Even a person knowing touch-typing faces problems. The QWERTY keyboard in PCs overloads the weaker fingers of the hands while almost ignoring the thumbs (which are much stronger with more brain support) – leading to the danger of RSI (Rapid Strain Injuries). Accuracy is now dependent on using everywhere the exact physical layout of the keys. This rules out the smaller adaptation of QWERTY keyboards in laptops and PDAs. The QWERTY keyboard has to be perched on a proper flat surface and requires a proper ergonomic seating posture. This precludes efficient use of portable, wireless QWERTY keyboards from, say, a sofa. Furthermore, since both the hands get tied up – it precludes, say, typing while having a snack. All this comes in the way for recording of thoughts while on the move. The good-old paper diary still remains handy.

1.3.3 Typing while on the Move

In the unfolding era of "wearable computers", the conspicuous absence is of a device which can be really counted on while one is on the move. Several attempts have been made in the past to fill this vacuum. The PDAs, (Personal Digital Assistants), specially the Palm compatibles, have supported a stylus oriented writing on a touch-screen. As hand-writing recognition has never been accurate enough, these PDAs use special "Graffiti" characters whose simplified strokes have to be learnt. It turns out, that this isn't also simple to master. The recent trend in PDAs is thus to support miniature QWERTY keyboard layouts. With this, the PDA is grasped between two hands and the

two thumbs are used to type on the miniature keys. The same method is used in "digital Diaries" and two-way Pagers, which have slightly longer QWERTY keyboards. The disadvantage lies in blocking both the hands. Furthermore, only sight typing is possible – preventing effortless transcribing of thoughts. Thus, practically these devices get relegated to those activities requiring keying of only small amount of text.

In parallel, however, another trend has been on the upsurge. It all started with usage of the TV remotes and cordless phones. The keys on these devices could be handled by one hand – either hand. Both of these devices sported a numeric keypad, allowing numbers to be typed with one hand. The most convenient method of typing was using the thumb of the hand while clasping the device in the palm. This trend was soon popularized in the mobile telephones, which were designed for a single-handed operation. The mobile devices, required simple entry methods for entering or searching for names. This was achieved by adapting the "ABC" overlay available on conventional telephone keypad. Each letter was input by multiple pressings within a short interval of time. The need then came for sending simple messages. Some mobile devices facilitated this by providing a spelling dictionary backed entry method such as a "T9". This obviated the need for multiple presses and resolved the ambiguity in word spelling by consulting a built in spelling dictionary. Surprisingly, this became quite popular, especially with the younger generation who became quite fluent in sending SMS messages by one hand, while on the move. A number of other numeric keypad overlays have been invented, each requiring multiple presses. These are difficult to learn and are suitable only for short text entry.

For proper email facility on a mobile telephone, the manufacturers still had to resort to miniaturized QWERTY keyboard, or stylus based writing on a touch-pad. Both of these require use of both hands and are unwieldy to use while on the move. The need was distinctly felt for a small hand-held device which would allow typing of all the ASCII characters, and permitted both sight-typing and touch-typing.

A candidate which partially fits the above requirement is the "Chord" keyboard. It is held in the palm of a hand with the four fingers and the thumb stroking one or more keys below them. Unlike the conventional keyboards, the Chord keyboard, requires multiple

keys to be pressed simultaneously by the fingers as well as the thumb, in order to generate all the codes required for ASCII typing. Naturally, this requires unconventional learning – which becomes even more difficult, since sight typing is not possible. This then has remained in the domain of the young enthusiasts. They love the freedom, of being able to type while not chained to the computer. The Chord keyboard, has been the only viable option for use with "wearable computers", apart for having to tie up a QWERTY keyboard between the elbow and wrist of a hand.

1.3.4 Invention – Filling the Vacuum

The invention thus proposes to fill the vacuum for a full ASCII keyboarding device which can become part of mobile phones, PDAs, two-way pagers, remotes and other hand-held computing/communication devices. It extends the habit of handling the numeric keypad of mobile devices, to full ASCII keyboarding along with navigation keys – all this with the thumb of a hand. It allows convenient hunt and peck typing for immediate use by anyone. It facilitates quick learning (from kids to grand-parents) by providing a straightforward "ABCD" layout.

The keyboard layout of the device is not just "user friendly", but "user obvious". By making the device look familiar, the initial resistance for usage disappears. A new user can start tinkering with the device without any guidance. The features of the device become clear through the usage itself. Alternatively, it becomes easy for people to casually introduce the device to each other. Features, once explained should be hard to forget.

The keyboard layout permits "thumb touch-typing" without having to look down on the key labels. Care has been taken to allow convenient, alphabetic/phonetic typing of European scripts and many other scripts of the world which are part of the UNICODE character set. Indeed, the keyboarding device can be used for output of ASCII/UNICODE character codes, which can be displayed on the accompanying internal display (LCD) of the device, or on an external display such as a PC monitor or a TV. Furthermore, the invention takes care of allowing a Pointer device, such as a track-ball, to be handled simultaneously along with the keyboarding – all by the same hand. Thus, the

device would permit remote single-handed operation, equivalent to that of a PC keyboard and a mouse.

By providing the missing ingredients, the invention would permit convergence of portable devices for communication, computing and multimedia – into a single pocketable device. This would permit evolution of a single device, which combines the features of a Telephony, Internet Browser, PDA, and Remote control. This device can have a unique IPv6 address, and can always remains connected to a local/global wireless network, allowing usage in myriads of applications, limited only by imagination.

This universal keyboarding device, would form the basis of an Electronics Nervous System, by which people can keep in touch with other people and devices connected to the internet, where-ever they are.

1.4 Objectives of the Invention

1. To provide capability of typing all the ASCII characters through a hand-held mobile device.

2 To ensure that the device can be operated equally well by either hand. This will, make people ambi-dexterous, and allow them to use the hand which is free at the moment. The device can be swapped between hands to reduce fatigue during extended usage. (This is not possible with Chord keyboard devices).

3. To provide a layout, which can be sight typed (hung and peck), by anyone who knows the English alphabet. This should appeal equally to a child who has just learnt his alphabet, as well as an elderly person who is reluctant to tackle the QWERTY layout of the existing keyboards.

4. To provide a key layout, which is thumb typable and can accommodate large variations in hand sizes and thumb-sizes.

5. To provide a key layout with sufficient tactile and positional feedback, so that it can be touch-typed without directly looking at the keyboard. (Thumb typing has to be conducted in an eyes-off manner, in order to become thumb tough-typing).

6. To provide a layout which with normal usage would automatically transform the sight-based thumb typing habit to eyes-free thumb touch-typing habit.

7. To ensure that there is no conflict in motor-memories (kept in cerebellum) for the people who can touch

8. To provide single-stroke typing for the basic 26 letters of the English alphabet as well as the Space key. This should be achieved, without the need to press multiple keys at the same time, as in the case of the Chord keyboards.

9. To provide a layout which in spite of having more than 26 keys, is still perceptually as simple as a numeric keypad of a mobile telephone. The objective is to avoid any mental inertia associated with learning of a complex looking device.

10. To provide ergonomic positioning of a hand for thumb-typing, for ensuring that Repeated Strain Injury (RSI) during thumb-typing becomes improbable.

11. To provide a convenient Homing key, which would serve as a reference for stroking all other alphabet keys.

12. To adhere to a straightforward "ABCD" layout and ensuring that it remains optimal for usage.

13. To eliminate the need for the "Shift" key as used in the conventional QWERTY keyboard, for changing between lower and upper-case alphabet or in general to select a related character. This eliminates the extra thumb travel required for stroking a separate Shift key.

14. To provide a Numeric/Punctuation overlay on tope of the basic alphabet keys. The Numeric Overlay should be easily touch typable. This overlay should also be optimal for usage for dialing telephone numbers, and use as a calculator

15. To provide a simple and intuitive method for keying the additional letters with diacritic mark in European languages. These letters are awkward for keying even on the conventional keyboards with QWERTY layout. Another objective is to provide Extended ASCII or UNICODE character codes for European language.

16. To provide a simple and intuitive method for keying the commonly used symbols, which are not found in the ASCII character set. Example: Degree, Copyright, Trademark, Euro, Yen etc. This again is a weak point of the existing QWERTY keyboards. These codes should correspond to Extended ASCII or UNICODE character set.

17. To provide a simple and intuitive method for keying all the non-Latin languages of the world using the basic English alphabet on the keyboard for reference. It should be possible to easily mix English with other languages.

18. To provide a thumb typable Navigation keypad, which will be used for direction oriented activities such as browsing, scrolling, cursor movement, TV/VCR/PC

control, games etc. The Navigation keypad should also include the commonly required keys for volume control. Even on the PC keyboard, the Navigation keypads is not accessible without removing the hand from the homing position.

19. To provide an adjustable Hand strap, which could hold hand in the proper position for thumb-typing, and ensure that the homing position is facilitated.

20. To provide a pointer device, such as track-ball, touch-pad, pointing-stick, or scroll-wheels which can be operated by the same hand in parallel to the keyboard.

1.5 Summary of the Invention

The mentioned Objectives are attained by the following design philosophy.

1.5.1 Basic Design of Alphabet Keyboard

1.5.1.1 Design Constraints

A hand-held keyboarding device meant for usage by either hand has to abide by lot of restrictions. Unlike the horizontal profile of a QWERTY keyboard, it has to have a vertical profile of a TV remote or a mobile telephone – the latter being handlable entirely by a hand. The latter category normally confines itself to a 12-key numeric keypad and some dedicated function keys. A keyboarding device, however, has to be able to cater to at least the entire 96 displayable characters and some additional control characters in the ASCII code set.

Adding to the numeric keypad, additional keys for typing Alphabet, Punctuations, Symbols and Control characters would make the hand-held device bulky indeed. The problem also is in typing these keys – which would normally require the other hand to help out.

Many users have become expert in typing digits and even alphabetic SMS messages using the alphabet on the numeric keypad of their mobile telephone. A letter is typed by

pressing a digit key several times. Multiple presses can be avoided by using the "T9" keyboard, which uses an internal spelling dictionary for the most commonly used words. The popularity of the SMS messaging on mobiles has shown the tremendous utility of a single-handed typing – which is possible even on the move

The bottleneck remains for typing long messages and emails on a mobile device. This normally necessitates a full function ASCII keyboard with Navigation keys, which can increase the size of the mobile device. The crux of the problem is typing all these keys by the same thumb in a convenient manner, without having to keep shifting the palm grasping position. In other words all the keys have to be "thumb typable".

1.5.1.2 Thumb Typing

Thumb is more suited for typing compared to other fingers – due to larger musculature, nerve endings and brain area for controlling it. The weaker fingers are prone to RSI (Rapid Strain Injury), in traditional typing on QWERTY keyboard. Thumb typing, would avoid RSI problems – and allow usage by almost all the people.

Thumb typing considerations would first limit the area in which the keys can be conveniently stroked by the thumb. Moreover the hand has to grasp the device in a manner that the thumb could be as much as possible in parallel with the top surface.

The invention overcomes the above problem by realizing that the "reach" of the thumb increases significantly by raising it high above the key surface, while continuing to grasp the device. This can't occur if the device rests in the palm, forcing the thumb to be close to the keys. Rather, the device needs to rest only on the fingers, with the palm curling up along the side of the device and raising the thumb high enough to flex freely from its joint.

A Hand strap is needed on the bottom surface of the device to ensure that the device doesn't slip off the fingers. The Hand strap would allow holding the device in a fixed position, for allowing consistent stroking of each key by the thumb. Consistency in stroking is the major requirement for "eyes-off" or touch-typing to develop. The "motor

learning" for thumb would be facilitated by ensuring that each key has unique and clearly distinguishable geographical position, shape and tactile feedback.

1.5.1.3 Homing Key

Touch-typing learning ease and accuracy depends on a well-designed "homing position". The conventional QWERTY keyboard uses the center row for "homing" the four fingers of each hand. For thumb typing, the need is to find a home key for the thumb which allows re-synchronizing, at-least once every word. Fortunately, the "Space" key, admirably fits the role, Using the Space as Homing key does justice to the most frequently typed character.

The Homing key being the "center", other keys in the "Alphabet keypad" have to be placed around it, such that the average travel between the Homing key and each alphabet is minimized. All this has to be achieved within the constraints of the thumb typable area. The width of this area has to be that of a normal TV remote. The height of the area can be a bit more. The height of the "Alphabet keypad" has to be minimized so that a "Navigation keypad" can be accommodated above such that it too remains thumb typable from the homing position. There is no possibility of accommodating any other keypad below the Alphabet keypad, since the thumb has limited reach in the downward direction.

The variations in hand sizes can be accommodated by ensuring that the Homing key and the surrounding Alphabet keypad, remains in the thumb-typing domain of even the smaller hands of 5 year-old children, who know their ABCD. Their thumbs may not be able to cover fully the Navigation keypad located above the Alphabet keypad – but in this case the other hand can stroke those keys.

1.5.1.4 Alphabet Keys

It is as such impossible, in the limited thumb-typable space, to give separate keys for all the displayable 94 characters in ASCII set – or even for the 47 keys used for this purpose in a QWERTY keyboard. QWERTY keyboard accommodates 94 characters on 47 keys, using the "unshift" and "shift" overlays, activated through the "Shift" key. From the operational ease point of view, it is necessary to have at least 26 separate keys for English

alphabet. Three additional overlays would be required for accommodating the 68 remaining characters in ASCII. These overlays have to be designed such that they are easy to remember and use.

We can make the 26 keys normally output the Lower-case English alphabet, as they are the norm for most of the typing. Unlike the QWERTY keyboard, we would reinforce this fact, by displaying lower-case alphabet on top of the keys. The Upper-case letters can be displayed through a "shift" operation. It is, however, more convenient to merely derive the Upper case by a "Long press" of a key. Thus, pressing the "a" key for more than 0.35 of a second (adjustable), would yield "A" character. This is not only intuitive, but saves a keystroke, which otherwise would have been required for a "Shift" key. Considering that the thumb could have had to stroke the "Shift" key too, the saving is significant.

The Homing key itself can output another character with a Long press. This can be a punctuation, which is used at least in every sentence. This is the 'dot" (".") character. With this, it is now possible to type simple sentences with Space and Dot characters.

1.5.1.5 Numbers & Punctuations (Nup)

The "Long press" concept has allowed fitting 52 lower and upper case alphabet on a single "Alpha overlay" on the 26 keys. It has also allowed fitting of the "dot" punctuation on the Homing key. We now need to accommodate the remaining 41 displayable characters in ASCII – again just one overlay would be sufficient if we use the "Long press" concept for deriving related symbols. Since this overlay consists mainly of Numbers and Punctuations, we call this overlay Numbers and Punctuation overlay or "Nup overlay".

Ten of the keys in the Nup overlay have to accommodate the 10 digits. These keys need not have any associated "Long press" symbols – as only 41 characters have to be accommodated in 52 positions possible with Short and Long press. As numbers have to be typed frequently in telephony and calculating applications, it is desirable to have the 10 Number keys closely positioned around the Homing key. The "dot" on the Homing key, now can serve as the decimal point, while typing in numbers.

The remaining 31 punctuation characters have to be allotted to the Short press and Long press positions such that the more frequent punctuations can be typed with a Short press. Where possible, it would be desirable to use the Long press for deriving a related, but less frequently used character. Thus "back-slash" ("\") can be in the Long shift position of "slash" ("/") – this would eliminate the typing confusion too, which exists in the QWERTY keyboard. The "semi-colon" can be in the Long shift position of the "colon" character as dictated by the frequency (the QWERTY keyboard though violates the frequency consideration). The "underscore" character can be in the Long shift position of the "dash" character. The "angular brackets" can be in Long shift position of the "normal brackets". The other punctuations have to be arranged with ease of remembering and usage in mind.

The Nup overlay legends can be displayed on a key, just after that for the Alpha overlay. Thus the number keys would only have two legends: a lower-case letter followed by a digit. Other keys would have three legends a lower-case letter followed by two punctuations. For ease in sight typing, it is desirable to show these legends clearly on the key-tops. Thus, in general, the widths of the three legend keys have to be a bit more than that of the two legend keys. The Homing key, would have the legends for Space and "." character – available in the Short press and Long press positions irrespective of Alpha or Nup overlay.

1.5.1.6 Nup & Nup Lock Key

If one is normally typing in the Alpha overlay, it would be necessary to shift over to the Nup overlay for typing a number or punctuation from it. This requires presence of a separate "Nup key" in the Alphabet keypad. The Nup key has to be pressed for allowing the next character (Short or Long press) to be selected from the Nup overlay, after which the normal Alpha overlay characters would resume. Many times, though, it is desirable to remain within the Nup overlay without having to press the Nup key for each character. This necessitates a key for "Nup lock", similar in concept to the "Num lock" as found in the QWERTY keyboards. The Nup lock key can allow toggling between the Alpha and Nup overlays. A Nup lock LED can display the status of the Nup lock

While remaining in the Nup overlay, it may be sometimes desirable to embed a single character from the Alpha overlay. The Nup key can again play a similar role – this time for allowing the next key to be selected from the Alpha overlay. For compaction and ease of recognition purposes, it would be desirable to use a key both as Nup key and the Nup-lock key in the Short press and Long press positions respectively. Nup key has to be in a Short press position since it is needed for deriving a single subsequent character, while the Nup-lock key can be in the Long press position since it will select a different overlay for all subsequent characters.

1.5.2 Extending for Other Languages

1.5.2.1 European Characters & Symbols

We have accommodated ASCII character set on a Homing Key and 26-alphabet key while using the Nup key for overlay selection purpose. ASCII, however, only caters to the English language. The extra characters required for European languages are contained in the Extended ASCII character sets. The additional European characters are generally formed by attaching a diacritic mark on an English letter (also called Latin letter). Extended ASCII also contains special "ligature" characters, and symbols such as "euro", "trade-mark" etc. Various language-specific overlays exist on top of QWERTY keyboard for typing these characters – many of them changing position of some ASCII characters, and deriving additional characters by using a "Compose" operations. The Compose operation on a PC keyboard, involved pressing of "Alt" or/and "Control" key along with a character key. Many symbols are actually typed in PC, by entering their three-digit code value using Alt key and the Numeric keypad. Needless, to say it is all very confusing and confounded – a legacy of patch on top of patch.

The invention aims to rationalize typing of the Extended ASCII character set, through an additional "Sym" (Symbol) key. The Sym key has to be followed by one or two keys for intuitively indicating the character to be derived. Thus "AE" ligature would be derived by pressing "A" and "E" keys following the Sym key. The letter with an Umlaut can be generated by pressing Sym key, "colon" key (has two dots, as in umlaut) followed by the letter key. The Short or Long press of the letter key would, as expected, make the change

in the case of the derived character too. The Euro symbol can be derived by following the Sym key by the "e" key. However, for the sake of keeping a uniform pattern for typing two keys after the Sym key, and accommodating a larger number of easily remembered symbols, we would use the Homing key between the Sym key and the "e" key. The Homing key after the Sym key would indicate that a non-language specific symbol is being derived, example: Sym key, Homing key and "t" would derive the "trade-mark" symbol. Use of the Homing key, contributes to ease in typing the symbols.

1.5.2.2 Sym & Caps Lock Key

For obtaining the same convenience, as in the QWERTY keyboard, a Caps-lock key would also be required. This then would allow changing the Alpha overlay to Caps overlay. In the Caps overlay, the upper-case alphabet would be in the Short press positions, while the lower-case alphabet would be in the Long press positions. Caps overlay selection can be indicated through an associated Caps-lock LED. Naturally, when the Caps overlay is active, the Sym key would derive the appropriate upper-case European character. The Nup overlay will remain un-affected by Caps-lock status.

Again, from the compaction, consistency and ease of remembering reasons it would be desirable to put the Sym key and the Caps-lock key in the Short press and Long press positions of a single key. In the Alphabet overlay, we thus need two extra keys for selecting between Nup overlay, Alpha overlay and Caps overlay.

1.5.2.3 Controls Keys

The requirements for typing ASCII/Extended ASCII won't be complete, unless some Control keys can also be typed. In the QWERTY keyboard, Backspace, Delete, Tab and Enter keys are the prominent Control keys, surrounding the 47 displayable keys. As the Tab key is required infrequently in modern text-entry operation, it can be placed in the Long press position of the Enter key. The Backspace key needs to be an "auto-repeat" key, eliminating the possibility of generating a different character in the Long press position. The Nup key can now be used in its generic sense for allowing a different but related character to be derived from a key. Thus if the Nup key is pressed before the

Backspace key, it functions as a DEL key (with auto-repeat). If the Nup key is pressed before the Tab key it will function as a Back Tab key.

1.5.2.4 Script Lock for other Languages

The invention does not limit itself to character set in Extended ASCII, and allows generation of codes for many languages contained in the UNICODE character set. For ease of learning and convenience of operation, phonetic Script overlays are defined for each of these languages. If the script is case sensitive these Script overlays would consist of a lower-case and an upper case overlay. The additional characters required for the language are derived through the "Sym key". In this scenario, the "Script lock" key would allow toggling between the English overlays and the Script overlays. For a language such as Cyrillic, which has both lower and upper case alphabet – The Alpha and Caps overlay would be displaced by the equivalent in Cyrillic. For languages such as the Indian, Perso-Arabic and Chinese, which don't have case differentiation only one Script overlay would be normally chosen, irrespective of the state of the Caps lock. However it is possible to use the Caps lock key for defining additional special purpose overlays for the script. Example: although Indian scripts require only one overlay, some of the additional characters required for Sanskrit/Vedic can be output when the Caps lock is on.

1.5.3 Physical Realization

1.5.3.1 Physical Layout using Key Blocks

The Alphabet keypad, thus comprises of Homing key, 26 character keys, and four control keys: Nup, Sym/Caps-lock, Backspace and Tab/Return – total of 31 keys. It is possible to squeeze all these keys in a thumb typable area of 4.5 cm (width) by 6.5 cm (height) by using miniature keys as used in remotes and mobile handsets. These keys can be organized in a matrix such as 3x10 or 4x8 or even 5x6. The Homing key, can be kept somewhere near the centre of this matrix, while the control keys can be kept at the periphery. The alphabet keys can be arranged in the alphabet order. The result, of this becomes extremely unwieldy for anything but the most simplistic operation of typing a sentence or two. It is difficult to sight-type (because of multitude of keys) and impossible to touch-type. Case, has to be exercised during the pressing because of the close spacing

of the keys; the thumb can easily cause adjacent keys to be pressed. More over, the vertical layout of keys in the devices is not amenable for retrofitting with the horizontal layout of keys in QWERTY keyboards – denying the advantage of familiarity.

The invention takes care of these fundamental problems in the physical layout of the keys by taking into account human engineering factors such as mental imagery, procedural memories and motor learning. The key concept lies in perceptual simplicity ushering navigation and learning simplicity. The human mind can comprehend instinctively, without strain, only a few things (3 or 4 ideally) at a time. The 26 alphabet keys are arranged such that they appear as only six "Key blocks", and two single keys, adjacent to the Homing key. This is possible by accommodating four keys within a single rectangular Key block – each key being activated by pressing one of its corners.

The Key block being a perceptual device, can be implemented as a four-way rocker switch, two two-way rocker switches, or even four plain switches. Care has to be taken that the four switches, blend into a single Key block, with a concave surface which raises the four corners. Simultaneous pressing of two or more keys in a Key block can be prevented through appropriate mechanical design as well as electronics logic.

The six Key blocks are arranged (Figure 1), such that two are to the sides of the Homing key, while four are in the diagonal directions. In addition, the two single keys are kept just above and below the Homing key. The Homing key and two single keys are recessed below the height of the Key blocks, such that wrong pressing of adjacent keys does not occur.

As discussed earlier the thumb is kept as parallel as possible to the keys, so that the key corner can be felt accurately. The motor learning technique involving moving from the homing position to one of the adjacent Key blocks, and then stroking one of its corners. Of course, the two adjacent single keys are even simpler to stroke. This two-step divided and conquer process, considerably simplifies the task of pressing any of the 26 keys.

Since a Key block becomes considerably more compact than equivalent four separate keys, it is possible to give extra space between the Key blocks to make navigation easier,

without possibility of adjacent Key blocks getting pressed. To conserve space the rectangular Key blocks on the side are oriented vertically, while the diagonal Key blocks are oriented horizontally.

The four control keys are accommodated in a row below the Key blocks. For perceptual simplicity and ease in use, these are again grouped in two Key blocks of two keys each. The control keys are recessed below the Key blocks, and are at the same height as that of the Homing key. The recessed position allows the control keys to be placed quite close to the four-way Key blocks, optimizing the height of the Alphabet keypad.

1.5.3.2 Assigning Legends to Keys

The simple and familiar "abed" layout is used for assigning legends to the Alpha overlay. The QWERTY layout is not amenable for vertical layout and thumb typing. More-over QWERTY layout is intimidating to the non-initiated people. The kids and uninitiated people, love using the intuitive "abcd" layout. The "abcd" layout though, has been further optimized for ease of use and learning. The layout design in fact reveals the neat structure of the English alphabet. Each of the six Key block contains four consecutive letters – leading not only to perceptual ease, but intuitive intra key-block navigation for consecutive character typing. Continuing in this manner, the two single keys above and below the Homing key, are assigned the Nasal consonants "m" and "n" respectively – these are distinct from other consonant and deserve the central positions. The last Key block thus ends up in "wxyz" arrangement. Each of the six 4-way key-block is now associated with a vowel: "a", "e", "i", "o", "u" and "y". Each word of the English language has to contain one or more of these vowels – the direction of initial navigation for these are then distinct. Moreover, after reaching the Key block the thumb needs to immediately press the top-left corner of the Key block for the top and middle row vowels – and the bottom-left corner for the bottom row vowels.

1.5.3.3 The Numeric Keypad

The ten key, Numeric keypad within the Nup overlay, fit quite neatly in the middle row over the two Key blocks and two single Keys. The Homing key, serves not only as a reference, but is handy for typing the Space character and decimal point. Numeric keys

were designed to be easy for touch typing: asset for telephone dialing, numeric data entry or calculations. The left Key block contains "1234", which is at the beginning of a normal telephone keypad. The "5" key, which is at the center of a normal telephone keypad, is also here in the central position, above the Homing key. The "6789" keys are accommodated in the right Key block – these keys are towards the end of a normal telephone keypad. The "0" key is placed below all other numeric keys, on the single-key below the Homing key – this also is the lowest key on the normal telephone keypad. The layout, although a bit different from that of the conventional telephone keypad is easy to remember. Since the structuring of the conventional and the new layouts are different, there is no conflict in the visual memories – unlike what happens between conventional telephone keypad and calculator keypad.

The Numeric keypad would be very easy for touch typing – allowing long phone numbers to be typed without having to look down. This is facilitated by, two-step, divide and conquer navigation technique. In the first step the thumb is moved to the left, right, top or bottom direction. The second step is needed only for the left or right keys, where the thumb strokes one of the four corners. The human mind finds, this process simpler, than a single step process of selecting one of the nine keys from the central "5" key of the conventional keypad.

The conventional 12 key Numeric keypad supports two additional keys: "*" and "#", placed on the left and right of the "0" key. These are required as responses, in some DTMF dialing applications. In the new layout the same "*" and "#" keys are kept to the left and right of the "5" key. Actually, the "#" key (not-equal key), is kept in the Long shift position of the "=" (equal) key. For DTMF dialing applications, however, the "=" key can be considered as synonymous to the "#" key – and a Long press is not required.

The Nup overlay has been optimized as a Calculator keypad too, the additional keys being accommodated in the keys adjacent to the middle row. Thus "%", "*", "=" and "/" keys are just above the Numeric keypad, while the "-" and "+" keys are below the Numeric keypad. Since the Space key is not required in Calculator application, it can be used as a decimal dot. The device would permit intuitive touch-typing in calculator

operations. The Nup overlay can also be used in a "hex calculator" mode, by using the "abcdef" keys and the numeric keys. The "*" key has to be used with a Long press in this mode. Nup overlay can be used as scientific calculator, with an alphabet letter for an operation being selected from the Alpha overlay using Nup key.

1.5.3.4 Placing Nup and Sym Keys

The control row contains the four keys, grouped as two Key blocks of two keys each. The Nup key and the Sym are towards the middle of the row, for ease in keying. The Nup key is just below the "," key, which is a prominent punctuation next to the dot. Other important punctuations such as dash, single and double quotes, colon, exclamation and question mark are placed in the bottom row, above the Nup key, to make their usage easy.

The Sym key gets used along with diacritic mark keys such as "^", "`", "¨", ";", "~" and "v" for deriving appropriate combination with a vowel or a consonant. This process becomes straight forward for usage and learning, since these keys are located in the bottom row, just above the Sym key and in the path of traversal towards the subsequent character – optimizing the total traversal required for deriving the new character.

1.5.4 Features for Completeness

1.5.4.1 Navigation Keypad

In order to be self-sufficient, like a PC keyboard, the device also requires a Navigation keypad. This would allow functions such as moving a cursor, scrolling, browsing and menus. It should also provide volume and mute control needed for TV and Audio devices. All this should be thumb typable, so that one can keep looking at the TV/PC screen while moving a cursor.

The Navigation keypad is located above the Alphabet keypad, since a thumb has flexibility of reaching for more keys in the upward direction. To cater to various sizes of hands one has to minimize the number of rows in the Navigation keypad to the minimum. Four direction arrows with a central "selection" key would require minimum of three

rows. There can be four additional keys in the diagonal direction from the "selection" key. These can cater to selection of modes, menus, and provide some browsing keys.

A volume Up/Down and Mute key can be provided on one of the side of the Navigation keypad.

A child's hand may not fully cover the Navigation keypad. In this case the fingers of the other hand can be used. In fact, for simple browsing applications such as for TV/VCT and presentation, the Navigation keypad can be operated without inserting the hand in the Hand strap.

1.5.4.2 Pointer Mechanism

The device can allow keyboard to be used along with a pointing device, such as a track-ball. This track-ball could have been used in place of some of the keys in the Navigation keypad. However, it is possible to retain the Navigation keypad, by accommodating the pointer under the device – directly below the Navigation keypad.

In this case the pointer device, has to be operated by the index finger, which should be kept out of the Hang strap. The index finger has to be slightly flexed outwards from its joint to the hand, for allowing it to roll freely on the track-ball.
The mouse buttons can be located in the Navigation keypad itself, and stroked in parallel by the thumb. The "selection" key can work as the Left-mouse button, and another "Menu" key can work as the Right mouse button.

1.5.5 Learning the Keyboard

The Alphabetic overlay is designed to immediately appeal to a first time user, whether or not such first time user is familiar with the QWERTY keyboard. Since the horizontal layout of QWERTY keyboard and the vertical profile of the "abcd" keyboard is quite different, there will not be any visual-memory conflict in usage. Since the finger motor memories used in QWERTY touch-typing are very different from thumb motor memories needed for thumb touch-typing – there won't be any conflict in touch-typing

The Alphabetic overlay, would allow the sight typing practice to automatically yield skills in touch typing – without any special training (as required for QWETY keyboards). This is possible, because the stroking of all the keys is done in a consistent manner by the thumb, facilitating the motor-memory (stored in the cerebellum).

A beginner should hold the device properly, by inserting the fingers of a hand in the Hand strap, and ensuring that the thumb is in roper position for stroking the keys. The palm of the hand should curl around the side of the device such that the thumb is high enough for stroking easily the extreme keys. The angle of the hand with respect to the device can be adjusted such that the thumb remains, as much as possible, parallel to the keys. The keys should be preferably stroked by flesh of the thumb below centre of the nail. The homing position should be the most convenient position, instinctively sensed by the thumb. Once comfortable, the grasping position for the device should not be changed in subsequent usage.

In certain instances the invention will find usefulness to an individual who is disabled because of the loss of one or more fingers. Such an individual may use the fingers available to perform the functions of the thumb and index finger as described in this disclosure.

A beginner can initially, always return back to the homing position after stroking a key. This will establish the initial mental-map required for accurately and instinctively stroking all the characters. After some practice, the user can type in all the characters belonging to the same Key block, before returning back to the homing position. Subsequently, characters in adjacent Key blocks can be stroked before returning back to the homing position. Finally, the words can be typed directly, with the homing being achieved automatically while typing the Space character in between the words. A mental map would have been created for jumping from one Key block to another Key block. Subsequent practice would automatically allow typing without having to see the legends.

1.6 Brief Description of the Drawings

Figure 1 is a perspective view of the

Figure 2 is an ASCII schematic Layout on Alphabet Keypad.

Figure 3 is a schematic arrangement of a Navigation Keypad.

Figure 4 includes Figure 4a, 4b and 4c which illustrates the device according to the invention and the Device Body Profile, and more specifically Figure 4a is Side View of the device illustrating the details.

Figure 4b is a bottom view and illustrates one proposal of the hand with three fingers engaged under the strap and the thumb and forefinger not under the strap; and

Figure 4c is a Top View showing the thumb in position to activate the keys.

Figure 5 is an electronic circuit of the device.

1.7 Detailed Description of the preferred Embodiment

The description below is given along with drawings, in order to clarify the working of the device. The description pertaining to the electronics is peripheral to the invention and given for the sake of completeness and better understanding of typical application of the device.

1.7.1 Figure 1: The Alphabet Keypad

Figure 1. shows the physical layout of the Alphabet Pad, with 11 keys from Key blocks 1 to 11. It also provides the dimensions of the keypad and the main Key blocks.

Key blocks 1 to 6 function individually as four-way rocker switches. Generous gas is provided between the Key blocks, as required to prevent accidental pressing of one of the adjoining keys while minimizing the thumb movement. Each Key block can be tipped by pressing on any of the four corners, whereby the electric contact below that corner is activated. The dashed lines within a Key block show the separation into four keys, each of which can be used for typing a separate character. The Key blocks have concave surface, such that the raised corners are easily felt by a thumb. These kinds of rocker switches are quite popular for direction based actuation in consumer devices – the primary difference is the diagonal orientation. Alternatively these Key blocks can be

implemented using four separate switches. In this case, a common key cap can cover the four switches and make them appear as a single Key block.

Keys 7 to 9 are recessed one-way switches, while Key blocks 10 and 11 are recessed two-way switches. Their height is such that when the keys are pressed they are at the level of the top surface of the device. In contract Key blocks 1 to 6 are raised above such that when they are pressed, they are still above the heights of the recessed keys, which otherwise may get pressed.

Key 9 is the Homing key and is placed in the centre of the valley created by Key blocks 1 to 6, and services as a convenient reference point. Keys 7 and 8 are triangular keys placed above and below the Homing key such that it is possible for a thumb to stroke them without pressing the adjoining keys.

Key blocks 10 and 11 are two-way rocker switches, as commonly found in the volume control buttons on consumer remote controls. The dashed line in each Key block demarcates the two keys. The electronic contacts are located below the left and right edges of a Key block. The Key blocks 10 and 11 have sufficient space below them, so that a thumb can stroke them without colliding with the raised Key blocks just above them (5 and 6). Alternatively, each of these Key blocks 10 and 11 could have been implemented with separate key switches.

1.7.2 Figure 2. ASCII Layout on Alphabet Keypad

The 26 lower-case letters in the English alphabet are accommodated on the keys of Key blocks 1 to 8, as shown, such that each letter is on a separate key. For "User Obviousness" purpose they are laid out in the alphabetic sequence, in a normal reading order (raster scan), so that locating and learning is not a problem. As such, each of the Key blocks 1 to 8 is adjacent to the Homing key 9 for facilitating thumb touch-typing. These 26 keys constitute the Alpha overlay. The 26 keys also support the Caps overlay and the Nup overlay.

The space character is allotted to the Homing key 9; since that will ensure that homing of the thumb will occur after each word. The Space character is output on Short press of the

Homing key. Long press of the Homing key results in the Dot "." character, required at least at the end of every sentence.

A Short press of a key in the Alpha overlay will output the lower-case letter as shown on the key legend. A Long press of the same key in the Alpha overlay will output the upper-case letter. This provides an intuitive, and efficient way of deriving the upper case letter without having to press a shift key, as in conventional keyboards.

When a long sequence of upper case letters have to be typed, it is better to select the Caps overlay by Long press of the Caps lock key (11.1). With this the Caps lock LED (13) will light up. On a subsequent press of the Caps lock key, the Caps lock LED will go off. The Caps overlay is case-wise opposite the Alpha overlay: Short press for upper case and Long press for the lower case.

Apart from the letters, each key in the Alpha overlay can output Numbers & Punctuations as shown in the key legends. But, for this the Nap (Number & Punctuation) overlay has to be selected. The Nup overlay also extends over the Key blocks 1 to 8.

When the Nup overlay is active, then a Short press of a key would output the 2nd character on the key legend. A Long press would output the 3rd character on the key legend, if present.

Nup overlay is activated with a Long press of Nup lock key (10.2). Subsequent Long press of the Nup lock key would re-activate the Alpha (or Caps) overlay. The status of the Nup lock, which works on a toggle basis, is shown by the Nup lock LED (12).

At any time, it is possible to temporarily shift from the current overlay, for typing a single key from the other overlay. The result is the same as toggling the Nup lock, typing the key, and then toggling the Nup lock back. This typing of one key from the other overlay is achieved after a Short press of the Nup key (10.2). After the up key is pressed the Nup lock LED (12) starts blinking until the next key is typed. The Nup key can be typed again for canceling itself. Thus a "," can be typed from the Alpha overlay by pressing Nup key followed by the "," key (5.4).

Key 10.1 allows BS (Back Space) to be typed for erasing the previous character. This key has an auto-repeat feature, so multiple BS characters are output as long as it is pressed. The Nup key can be typed before the BS key, for allowing the DEL character to be output, for deleting a character to the right. Note, that action of Nup key affects the code/codes output by the subsequent key, until it gets released. This implies, that when the BS key is pressed after the Nup key, it will keep outputting DEL characters as long as it remains pressed.

A Short press on key 11.2 outputs an Enter character. A Long press on key 11.2 outputs a Tab character. When the key 11.2 is short pressed immediately after the Nup key, then a Reverse Tab character is output. Note, that there is no auto-repeat on the Enter/Tab key.

Sym key (Short press on key 11.1) is used for deriving letters and symbols not directly shown on the ASCII layout, and which is part of the Extended ASCII character set. When Sym key is typed, the Caps lock LED (15) located below it starts blinking and a two character mnemonic (based on the key legends) is typed. The Extended ASCII character corresponding to the mnemonic is then output, and the Caps lock LED stops blinking. For example a "u" with an "umlaut" will be indicated by typing ":" (key 6.5) followed by typing of "u" (key 5.3). If a capital "U" with an umlaut is needed, then in the previous example the second character ought to be "U" (A Long Press). In the example above the *key containing colon is typed, and not the colon* character (colon typing would have required pressing a Nup key before it). Please note that only a Short press of the key containing the legend for the first character after Sym is required. In this manner Sym key allows output of all the additional characters required for European languages as contained in the Extended ASCII character set.

The Sym key followed by Space key (9) and then the "e" (key 2.1), will output the Euro symbol. In general Sym followed by Space key, will allow output of various symbols on the subsequent key. In this manner the Sym key allows output of all the Extended ASCII Symbols such as TM, Degree, Euro and Copyright.

The Alpha and the Caps overlays in conjunction with the Sym key, permit typing of most of the languages written in the Latin script (Roman script) with characters in the Extended ASCII character set, or in the first two code pages (256 characters) of the UNICODE.

The device permits typing of most of the non-Latin script languages too using Script overlays. Most of the Script overlays, can use a scheme whereby the Latin transliteration (also called Roman transliteration) is actually typed using the existing English legends on the keys. Additional unique characters in the script can be typed using the Sym key. In this manner, it is possible to type in non-Latin phonetic/alphabetic scripts such as Indian scripts, Perso-Arabic scripts, Cyrillic, Thai, Tibetan, Bhutanese, Burmese and Sinhalese.

The required non-Latin script can be pre-configured in the device or selected from a menu on Local or External display. The Script lock key will now allow toggling between the ASCII overlays and the Script overlays. Key 11.1 has to be short-pressed twice (within 1 second), in order to activate the Script lock – which is indicated by lighting of Script lock LED (14). Key 11.1 can be again short-pressed twice to deactivate the Script Lock.

If the selected script is case sensitive, such as Cyrillic, then the Caps lock will select between the applicable lower-case and upper-case overlay of the Cyrillic script. The Sym key, followed by one or two characters, would now be used to select characters which are not directly available on the alphabet keys. Note that the Caps lock LED (13) will blink for one or two characters as needed for the script. If the selected script doesn't have two cases, such as the Indian scripts, then the Caps lock normally won't have any effect on the Script overlay (unless the Caps lock is made to select another special purpose overlay for the script). In Indian scripts the Sym key can be followed by one of the script overlay characters to derive a related script character. Some other non-Latin scripts may require two characters following the Sym key.

The Nup overlay can be accessed in the conventional way while using a Script overlay. The ASCII Symbols are also typed in the same way, while using the Script overlay, by

following Sym key with Space key and another character key. The Caps lock LED, will in this case blink for two characters.

1.7.3 Figure 3: Navigation Keypad

The Navigation keypad is located immediately above the Alphabet keypad on the top surface of the device. The Navigation keypad complements the Alphabet keypad, to provide equivalent functionality of conventional PC keyboards.

Key block 1 is for volume control. Key 1.1 increases the volume while key 1.2 decreases the volume; both work on an auto-repeat basis.

Key block 2 is for Mute/Hide. A Short press will cause the sound to be muted or unmated on a toggle basis. Mute will be deactivated when either of the volume keys 2.1 or 2.2 is pressed. A Long press will work as a HIDE key toggle. It will cause a text overlay on a video/image on an External display to be hidden or revealed.

Keys 3, 4, 5, & 6 are the four Direction keys, which on a Long press would auto-repeat.

Keys 7 to 11 are non auto-repeat keys, where the short and the long presses are distinguished. Key 7 is the OK key, which causes an item to be selected on the Local display or an External display (of a PC or a TV). Key 7 also works as a left-mouse key in conjunction with the pointing device. A Long press of the OK can be used for selecting a related action.

BACK key (Short press on key 10), will cause quitting to a previous screen of an application. HOME key (Long press on key 10) would show the Home screen on the local or External display. The result of the HOME key is the same as that of a series of BACK keys: thus the positioning as Long press.

START key (Short press on key 9), is used typically to show the Start screen/menu on the External display. STANDBY key (Long press on key 9), can put the External display device in the Standby mode, or wake it up if it was in the Standby mode.

MENU key (Short press on key 11) will cause a context sensitive menu to pop up on the Local or External display, much like the right-mouse click menu on a Windows screen. LOCAL MENU key (Long press on key 11) allows a Local menu to be displayed on the Local display of the device. The Local menu allows local settings of device modes and configurations.

MODE key (Short press on key 8) determines the mode of the Direction Keys. For example the Direction keys can be used as Cursor keys in the default Direction mode and as Scrolling keys when the MODE key is pressed. The MODE key will toggle through the available Direction modes. The MODE LED (12) will be lighted in a non-default Direction mode. A Long press on the MODE key will always revert to the default Direction mode and turn off the MODE LED.

In addition the Navigation keypad can have two LEDs 13 and 14, for indicating transmission and reception of characters respectively by the device.

1.7.4 Figure 4 Device Body Profile

Figure 4 shows representative views of a preferred embodiment of the device, with the pointing device as a track-ball. Although the right-hand examples are given out here, the device could very well have been held and operated by the left-hand.

As noted heretofore, it is contemplated within this invention for an individual with two useful digits to operate the device.

Figure 4a shows a side-view of the device. Figure 4b shows a bottom view of the device, with right-hand positioned to use the device. Figure 4c shows a top view of the device, with right-hand positioned to use the device. The thumb is over the Homing key.

The top surface is nearly or substantially flat and contains the Navigation keypad (4.1), Alphabet keypad (4.2) and Local display (4.3). The specific order is to facilitate thumb touch-typing by a hand (4.9). The central area with the Alphabet keypad (4.2) is the most convenient to stroke and has the Homing key. The navigation keypad (4.1) is accessible

by flexing the thumb upwards. The Local display (4.3 – mostly LCD display), in this embodiment, is located in the area which is difficult for the thumb to reach.

The bottom surface of the device (4.6) has a slant or inclined position which tilts the palm such that the index finger is higher than the little finger or the pinky finger. This tilt of the palm helps in making the thumb as parallel as possible to the top surface of the device – contributing to ease in thumb typing.

A Hand strap (4.7) is provided to keep the fingers of the hand (4.9) in proper place. The diagrams show three fingers inserted inside the strap, while the index finger is free to operate a pointing device – in this case a track-ball (4.5). If the pointing device was not or is not to be used, all the four fingers could have been inserted inside the Hand strap (4.7). As seen from the diagram, the fingers do not jut out of the device, so that the palm of the hand can be curbed around a side of the device with the thumb getting raised high-enough for proper access of the keys. The Hand strap is laced in such a manner that it does not come in the way of proper horizontal placement of the device on a desktop, for sight-typing with fingers.

The track ball (4.5) is positioned such that the index finger can slide over it, and in the process moves the track ball in the desired direction. For moving a pointer vertically upwards on a screen, the index finger starts from the strap adjacent position, gets pushed away from the device as it slides to the centre of the track ball and gets splayed towards the top edge (4.4) of the device. For horizontal movement of a pointer on a screen, the index finger moves inwards or outwards from the palm.

The OK and Menu Key in the Navigation keypad (4.1) are stroked by the thumb, for getting equivalent of left-click and right-click on a conventional mouse device. The thumb can act in parallel with the index finger which may be moving the track-ball.

1.7.5 Figure 5. Device Electronics.

The microprocessor (5.5) and entire electronics is powered by a battery (5.3). Power conservation is exercised by putting the microprocessor in the sleep mode, whenever possible, and waking it through an event such as key press, wake-up timer or received

character. The microprocessor and many of the peripherals can be incorporated in a single ASCI, for purpose of clarity many of the peripherals are shown separately. The microprocessor can contain enough RAM, ROM, and E2PROM/FLASH memory as required.

The Microprocessor scans the key matrix (5.4) which allows detection of any key pressed. A software logic ensures that a key contact is recognized only when no other key is pressed simultaneously within the same Key block.

Microprocessor sends and receives characters via TX interface (5.1) and RX interface (5.2) respectively. These interfaces can allow communication via infrared or RF. Alternatively the TX and RX interfaces can be for a wired protocol such as USB.

The Microprocessor drives the LCD screen (5.7) through a LCD Driver (5.6). It can also display some status signals through LEDs (5.11).

The Microprocessor takes in the signals from a pointer device 5.10 (such as a track ball). The mouse buttons for this device are detected through the key matrix (5.4).

The Microprocessor can also take in a microphone input (5.8) through an internal A/C converter, and output an analog signal for driving a speaker (5.9). It can also drive a Buzzer (5.12).

While particular embodiments of the invention have been shows and described, it will be obvious to those skilled in the art that various changes and modifications may be made without department from the scope of the invention in its broader aspects. Therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

CLAIMS:

1. A hand held thumb typable ASCII/UNICODE keyboard with a pointing device for mobile communication/computing, with a physical layout of the keys comprising:

an Alphabet keypad arranged in a specific pattern to optimize the thumb touch-typing, wherein a single-stroke Homing key is at the centre, with six rectangular four-way rocker Key blocks arranged in the NW(1), NE(2), W(3), E(4), SW(5), & SE(6) directions;

each one of the four keys in said rocker Key block, being activated by pressing one of the four corners; and

two single-stroke triangular keys provided in addition in N(7) and S(8) directions adjacent to Homing key (9);

said single stroke keys (7 to 9) being recessed below six four-way Key blocks (1 to 6).

2. The keyboard device according to Claim 1, wherein four additional single-stroke keys are arranged above or below said keys; and said four keys are organized within two two-way rocker key blocks (10, 11) and kept below Key blocks (5, 6) respectively.

3. The keyboard device according to Claim 1 wherein the keys are used for typing ASCII/UNICODE characters.

4. The keyboard device according to Claim 3, wherein the Key blocks 1 to 9 are used for typing alphabet and the Key blocks 10 and 11 are used for selecting overlays and some control characters, and overlays are used to accommodate displayable 94 characters in ASCII.

5. The keyboard device according to Claim 4, including separate overlays over the alphabet keys for typing Numbers/Punctuations, Numbers 0 to 9, are centered around the Homing key, for easy accessibility, said Homing key using the space bar as a function key for the Homing key and a dot.

6. The keyboard device according to Claim 5, wherein distinction is made between a short press of a key and a long press of a key to enable deriving of related characters.

7. The keyboard device according to Claim 6, wherein the Alphabet and Numerals are laid in a sequential manner, whereby to render it easy for any one to follow and remember.

8. The keyboard device according to Claim 7, wherein a separate lock key (Nup) is used for selecting between Alphabetic overlay and Number/Punctuation overlay.

9. The keyboard device according to Claim 8, wherein a separate key (Sym) is used for allowing additional non-ASCII characters to be derived, by typing one or two keys after the Sym key.

10. The keyboard device according to Claim 9, wherein a separate key is used for setting the Caps lock or Script lock status as reflected in their respective LEDs. Script lock allows selection between overlays for Latin (Extended ASCII) and a selected language (UNICODE) while Caps Lock is used to select between the lower-case and upper-case overlays if present in the language selected through the said Script lock key.

11. The keyboard device according to Claim 10 including a Navigation keypad consisting essentially of a Mute key (2) and Volume keys (1.1 & 1.2) for audio control,

said keys being locatable on either side of the device; said keypad also contains a central OK key (7) with four Direction keys (3 to 6) and four diagonal directions keys labeled: Mode (12), Start (9), Back (10) and Menu (11) keys.

12. The keyboard device according to Claim 11, including a body profile for ensuring that the device is held with a slight tilt of the palm suitable for holding the thumb in the Homing position and as parallel as possible to the top surface; said profile being configured to ensure that when the device is kept on a flat surface, the keys on the top surface remains parallel to the flat surface as required for hunt and peck finger typing.

13. The keyboard device according to Claim 12, including an adjustable Hand strap attached to the bottom of the device; said strap allowing three or four fingers of a hand to be inserted to provide a firm grip for holding the device for thumb touch-typing; the palm of said hand remains outside the strap and enables lifting of the thumb high enough for allowing typing of all the keys on the top surface; the Hand strap being mounted such that it allows the index finger to remain outside the strap for operating a pointing device as needed; and wherein the device is grasped by the hand in a manner so as to enable the thumb to be used in parallel with the top surface, while having the device rest only on the fingers with the palm curling up along the side of the device and raising the thumb high enough, to flex freely from its joint.

14. The keyboard device according to Claim 13, including a track-ball pointing device operated by the index finger; the thumb being used simultaneously to press the OK key and Menu key (Figure 3, key 11) on the top surface, which work like the Left

and Right mouse click buttons; and only three of the four fingers are inserted into said strap.

15. The keyboard device according to Claim 14, wherein the pointing device is a track-ball mounted such that it can be used on a flat surface as a mouse device with a full ASCII keyboard on top of it.

16. The keyboard device according to Claim 14, wherein the pointer device is a touch-pad which can be operated by sliding the index finger on it such that only the thumb and one finger performing the functions of the index finger is necessary for the operation.

17. The keyboard device as claimed in Claim 14, including two additional sideways operated switches – meant for activation by the index finger and the little finger for selection of some overlays, for allowing faster thumb touch-typing.

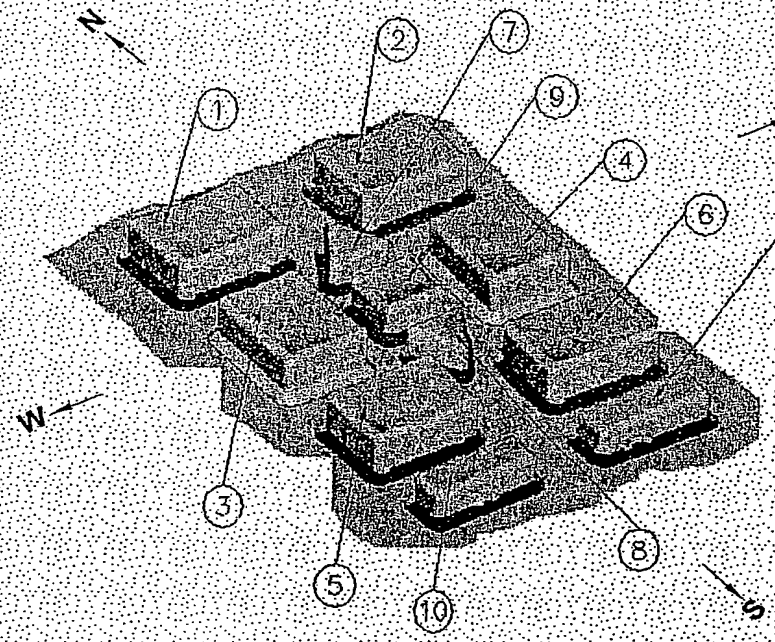
18. A method for using a hand-held thumb tough typable ASCII/UNICODE keyboard with a pointing device for mobile communication/computing;
providing a track ball navigation keypad and a pointing device to complement an alphabet keypad;
providing the navigation keypad and pointing device with a adjustable strap for permitting three or four fingers of a hand to slide into position with the thumb raised sufficiently high enough to stroke all of the keys on the top surface with the index finger to operate the track-ball pointing device;
providing a key layout for thumb typing including a keyboard for tactile typing and positional feedback; and

providing single-stroke typing for at least twenty-six letters of the English alphabet, while keying all non-Latin languages;

19. The method as claimed in Claim 18, including a Homing key as a reference for stroking all other alphabet keys and an "ABCD" layout optimal for usage, and an intuitive method for keying commonly used symbols not part of the ASCII character set, providing an extended ASCII and UNICODE character set to enable mixing of English with other languages and a numeric/punctuation overlay on top of alphabet keys for dialing telephone numbers and use as a calculator.

20. The method as claimed in Claim 19, includes providing the thumb typable navigation keypad for movement in directions oriented activities including browsing, scrolling, cursor movement, TV/VCR/PC control, games, volume control, all without the necessity for removing the hand from the Homing position.

Figure 1 ALPHABET KEYPAD



DIMENSIONS	HEIGHT	WIDTH
Keypad	6.4 cm	4.4 cm
Key Block (1,2,5,6)	1.6 cm	1.5 cm
Key Block (3,4)	1.2 cm	1.2 cm
Space Key (9)	1.0 cm	1.3 cm

Figure 2: ASCII LAYOUT ON ALPHABET KEYPAD

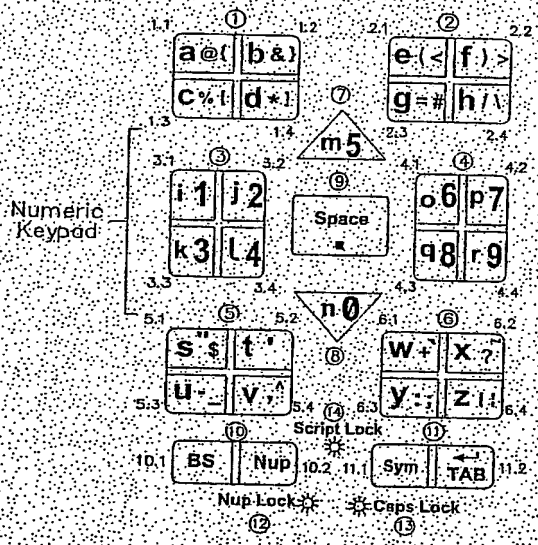


Figure 3: NAVIGATION KEYPAD

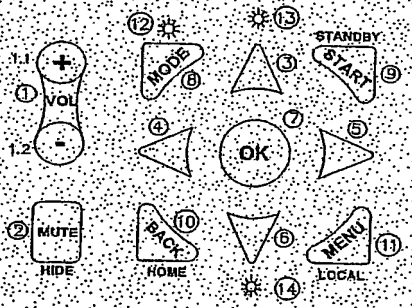


Figure 4 DEVICE BODY PROFILE

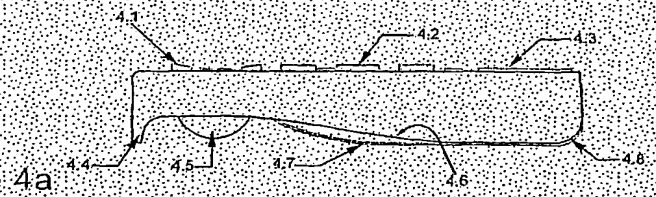


Figure 4a
SIDE VIEW

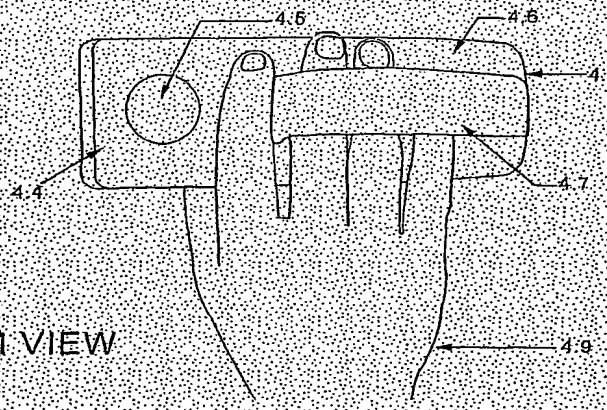


Figure 4b
BOTTOM VIEW

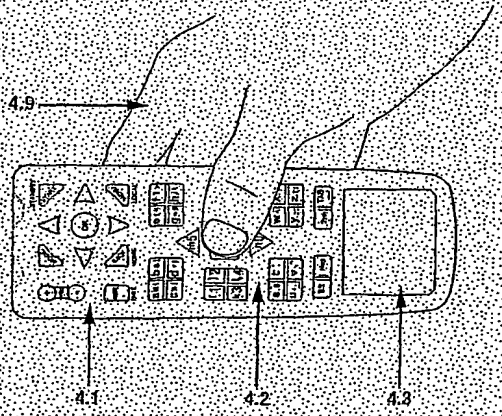


Figure 4c
TOP VIEW

Figure 5: DEVICE ELECTRONICS